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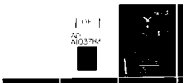

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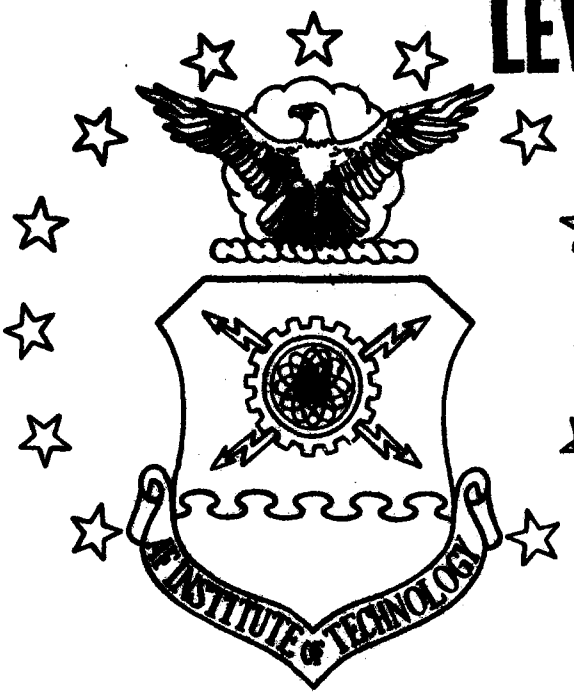

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LEVEL II 3

A STUDY OF THE FACTORS AFFECTING PRODUCTIVITY AT THE NAVAL AIR REWORK FACILITIES

Janice Allton, 2d Lt , USAF
Stephen N. Bernard, GS-11

LSSR 10-81

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The purpose of this study was to determine the factors affecting productivity at Naval Air Rework Facilities (NARFs). Specific points addressed were number and identity of factors, internal consistency and usefulness in predicting perceived productivity. A seventy-two item questionnaire was administered to a random sample of NARF production-line employees. Five hundred thirty-four cases were factor analyzed. Eleven factors extracted were discussed. Eight of these were used to develop a linear multiple regression model to predict perceived productivity. Approximately twenty percent of the variance in perceived productivity was predicted, with five independent variables (factors) - work scheduling supervision, overtime, training quality and equipment. These factors generally substantiated those found in current literature.

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A STUDY OF THE FACTORS AFFECTING PRODUCTIVITY AT THE NAVAL AIR REWORK FACILITIES

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

By

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This thesis, written by

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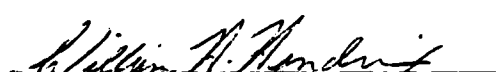

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CHAPTER I

INTRODUCTION

Thesis Problem Statement

There is a need to identify the factors affecting productivity at the Naval Air Rework Facilities (NARFs). A NARF is a depot-level aviation maintenance activity.

Expert opinion in the naval industrial community and existing literature indicates there is a lack of information available about the factors affecting productivity.

Background

Production may be conceived as the process of transforming resources into useful products and services. The degree of success depends upon the conservative and effective use of resources and the efficiency of the transformations used. This degree of success is the productivity of an organization.

There are many possible definitions of productivity offered in the literature. One that addresses the aspects of quality and resource identity is:

> the ratio of goods and services produced by an activity to the resources consumed in that production. The output is measured in both quantity and quality, and the inputs can consist of a variety of resources - labor, capital, energy or any other selected factor of production [15:3].

In Kendrick and Grossman's study of productivity in the United States, they define 'total factor productivity' as that gain in output which is above the labor and capital inputs growth (18:6).

In October 1978 the National Productivity Center (NPC) was created to direct the Carter Administration's productivity programs. Preceding the NPC were the National Center for Productivity and Quality of Working Life, and the National Commission on Productivity (33:29), all Executive Branch agencies. There are sound economic reasons for the governmental attention this subject has received. One relates to the cyclical aspect: as production drops off, there are less resources made with which to build productive capacity (37). Others include the need to improve the environment, reduce unemployment, develop energy sources and fund social programs (36:4-5).

As demand for products increases and costs of resources rise, increased emphasis must be placed on improving production. The rapid changes which have taken place during the 1970s in resource availability and energy costs necessitate swift adjustment by the industrial community. The current condition of the United States economy is as good a witness as any to the need for more effort in studying ways in which productivity can be increased. In their study of the relationship between productivity and inflation, Freund and Manchester advance a multiplier model whereby a one

percent increase in productive efficiency results in considerably more than one percent inflation reduction (32:2). Likewise, they claim, increasing inflation reduces productivity growth by creating business uncertainty, and increasing the effective taxing of corporations and investors. Denison, a noted authority on the subject, discusses the economic impact of productivity and discusses the trends of productivity growth from 1929 to 1975 (26:19-28).

The negative trend of U.S. productivity growth is evident in the following record (36:1):

from 1948 - 1966 up 3.2% per year
1967 - 1973 up 2.3% per year
1974 - 1976 up 1.1% per year
1977 up 1.6%
1978 up .5%

In 1979 the nation experienced its first productivity decline since 1946 (37:B1). This trend is contrary to the expected upturn in growth following recovery from the business contraction of 1973-75 (18:1). Referring to this phenomenon, Denison stated, "no single hypothesis seems to provide a probable explanation of the sharp change [in productivity growth] after 1973 [5:145]."

The technologically advanced countries of Europe and Japan have steadily increased their productivity in the last decade through increased use of automation, modern facilities, and employee incentive systems. Foreign successes have

influenced American politicians and businessmen to consider policy changes which will enhance U.S. industrial performance. For example, in his statement before the Joint Economic Committee, Eugene Merchant asserted that productivity research and development must be addressed by government, universities and business through cooperative action (33:13). C. Jackson Grayson, Director of the American Productivity Center, emphasized the involvement of the employee in improving productivity as a reason for the rapid rise in productive efficiency experienced by other technologically advanced countries and supported a similar movement in U.S. business (3:4-6).

With respect to government productivity, O'Rourke points out the outputs in the public sector are harder to measure than in private industry (30:11). Problems concerning productivity definition and measurement in the public sector were discussed by Alan K. Campbell, Director of the Office of Personnel Management, in a presentation for the Joint Economic Committee (33:49-50). Elmer B. Staats, Comptroller General of the United States at the time, recommended quantifiable productivity measures be developed by Federal agencies and cited work being done by the Government Accounting Office on productivity assessment (33:63). It is clear that there is keen government interest in the area of definition and measurement both for public and private sector enterprises because of the importance of productivity to economic progress.

A recent conference on productivity concluded that, unless it is increased, economic growth and the national standard of living cannot be improved. It was also pointed out that six major industrial nations have now surpassed the United States in rate of productivity growth (24:1).

Five major categories of factors which affect the nation's productivity have been identified:

- People - demographics, stress, incentives, numbers, value systems
- Capital Resources - investment, funding
- Government Regulation - paperwork, compliance
- Technology - methods, equipment
- Working Environment - facilities, politics, media [15:19].

If these categories can be accepted, it follows that the decline of productivity growth is attributable to such factors as:

- changing demographics of the labor force
- increased costs of materials and energy
- decline in capital investment and research/development expenditure
- government policies, including tax structure and regulation
- economic condition of the nation [15:iii-iv].

These contributory factors can be collapsed into three reasons for the current decline:

- the shift from labor saving to energy saving and the costs incurred.

- government regulation of environmental impact and worker safety.

- economic uncertainty over inflation's effects and possible government intervention (15:53-54).

More recently, the phenomenon has been attributed to the slow growth of capital, the inability of the economy to grow as it has normally done, and a slowdown in the rate of technical change (24:349-352). In its final report, the National Center For Productivity and Quality of Working Life identified four key areas:

- concern for the well-being of employees

- incentives to improve productivity and control work performance

- incorporation of new technologies

- improving organizational capacity to accomplish goals (25:57).

Having recognized that productivity is important and having identified the major factors that affect it in the broad sense, it remains to find ways in which individual organizations can assess their productivity and improve it.

The organization's effectiveness must be viewed in the context of its goals. Cameron found governmental organizations a particularly difficult type to evaluate because of complex changing and contradictory goals and lack of feedback within the group (2:70-71). Such characteristics are not conducive to employee satisfaction and job identification,

key aspects of worklife to focus on and control according to Mikalachki. He contends that absenteeism, turnover, negative attitudes and stress can all be relieved through good job design and careful initial selection of employees (22: 34-37).

According to Umstot, Mitchell and Bell:

> What is needed is an integration of goal setting techniques and job enrichment techniques with goals facilitating higher productivity and job enrichment promoting job satisfaction and improving quality of working life for employees [41:868].

They go on to assert that goal setting appears to lead to increased performance more efficaciously than job enrichment does, although both are important factors in improving productivity through use of a job design model (41:878).

In a laboratory study, Farr determined that group and individual incentive plans played an important role in increasing an organization's productivity (8:168). Demanding increased output without providing proper incentives results in employee discontent and, eventually, in a decrease of productivity, according to Margolis (19:23). Management effectiveness and worker participation are seen by Glaser to be crucial to the enhancement of the organization's productivity. Involving employees in the decision-making process at all levels is considered the key to quality of worklife improvement (10:73-74).

Herzberg asserted that people are motivated by responsibility and involvement in the organization's business

(13). Herzberg's job enrichment techniques have received attention in industry for their usefulness in improving productivity and reducing absenteeism. Results of an Orthodox Job Enrichment (OJE) program applied to an aircraft overhaul activity at a major Air Force logistics facility were reported by Svoboda. The program surveyed 40 pre-OJE and 98 post OJE employees on several 'motivators' - achievement, work itself, responsibility, advancement and recognition. In all parameters except 'recognition' they found improvement (39:29). The program's financial success resulted in the authorization of similar projects at several other Air Force Logistics Command facilities (39:31).

The idea of involving the employee in organizational decision-making was well-articulated by McGregor (20). His "Theory Y" emphasized the active role employees can and should play in the maintenance and improvement of the organization.

According to Reiker, the teachings of Herzberg, McGregor and other Behavioral scientists were coupled with the statistical approaches to quality control pioneered by Denning, Juran and Ishikawa (34:27-28) to create a concept now called "quality control circles" (QCC). QCC is a participative management technique which has resulted in significant increases in productivity and worker motivation in Japan and, to a lesser extent, in the United States (16:27-28). The quality circle concept is currently employed in

some Air Force Logistics Command activities (4,38) and is being developed in the Navy Material Command (45). Moore and Stevens are currently studying the implementation of quality circles in the Air Force (23).

This study attempted to identify and quantify factors which affect productivity, using responses to a questionnaire administered to a sample of NARF employees. This was accomplished by factor analyzing employee responses to questionnaire items. A linear regression model was then developed, using the identified factors to predict the factor 'perceived productivity'. Items concerning supervision, job satisfaction, organizational climate and perceived productivity were drawn from the Organizational Assessment Package for Air Force Organizations (11). Specific work-related items were developed for this study from current literature and interviews with NARF managers.

CHAPTER II

LITERATURE REVIEW

The Department of Defense (DOD) is vitally concerned with productivity enhancement, both in organic activities, such as Air Logistics Centers and Naval Air Rework Facilities, and in the commercial sector. This concern is focused on enhancement of in-house effectiveness (31:2), but it is recognized that greater industrial production efficiency in the commercial sector results in lower costs to the DOD for the goods and services it purchases (43). In August 1975, DOD Instruction 5010.34 was adopted for the specific purposes of enhancing, measuring and evaluating productivity throughout the DOD and all associated agencies. The instruction is particularly concerned with efficiency of both resource productivity (operating and investment fund resources) and labor productivity of organizations with respect to the accomplishment of their missions (42:1, Encl.1). It has identified four significant ways to increase productivity (42:2, Encl.1):

1. Methods and Standards Improvement - reducing work processes to a bare minimum and refining labor standards.

2. Capital Investments - investing in equipment, facilities and tools to improve efficiency.

3. Training - providing needed skills and knowledge to employees.

4. Motivation - motivating employees through increased job satisfaction.

Through this instruction, DOD components are required to submit, annually, goals for productivity improvement, divided among major commands and agencies (42:2, Encl.1). The data fed back by the components shows where projections of improvements are, and are not, being supported by actual experience (42:3, Encl.3).

Recognition of the needs for productivity enhancement is evidenced in several recent studies.

In 1977, Powers looked at productivity from a DOD perspective. He found that in the five years preceding 1977 national spending went from $50 billion to $400 billion, while the amount given to DOD had declined by $17 billion. At the same time, procurement outlays were at their lowest in 27 years and material acquisition costs had increased (31:3). He pointed out that more than 50% of the budget goes for wages and maintaining wage comparability with the business world means productivity must improve.

Contracting with the private sector is one area which DOD has targeted for cost savings through productivity enhancement. By motivating them to use more cost-effective methods of producing systems, DOD can reduce acquisition and support costs (31:3). Powers cites two management techniques

that are currently in use to improve productivity. The first one is the Air Force Military Standard on Work Measurement designed to set up minimum criteria for measuring work. The second is the Quality Assurance Certification Program designed to strengthen the contractor's quality assurance program, hence reducing government inspection costs (31:5).

The Department of Navy, concerned with productivity improvement, published SECNAV Instruction 5200.31 in June, 1978. This program "establishes policy on and provides guidance for the Navy's productivity improvement program and assigns broad responsibilities for conduct of the program [24:2]." In Particular, it established a Productivity Coordination Council of nine top Navy executives to make sure policies and programs were carried out. It also appointed a Department of Navy Productivity Principal in the office of Assistant Secretary of the Navy (Manpower, Reserve Affairs and Logistics), to coordinate with other DOD agencies (28:2).

A study written from the Department of Navy perspective cited several programs designed to improve productivity, such as OMB Circular A-76, the Manufacturing Technology Program, the Fast Payback Capital Investment Program and the Beneficial Suggestion Program (36:13-14).

A recent study which sought to determine what factors impede productivity was conducted at NARF, North Island. A total of 77 people were interviewed from the five

production divisions to identify the impediments to productivity in their particular division. Voluntary group interviews were held with supervisors and then with journeymen. Nominal Group techniques were used and the most serious impediments were identified (44:5-7). The conclusions of this study were varied. First, it was determined that the mission of the NARF needed to be clearly defined. Secondly, it was clear that each factor (parts, labor, materials, equipment, etc.) needed to have an optimum funding level established, as inadequate funding was common to all impediments. Thirdly, they needed the funds that were identified at the optimum level.

Another study at NARF, Cherry Point, North Carolina, attempted to gain information about goals, performance levels, and over-all efficiency of the facility (35). Rockwell found that the performance measure used for comparing productivity was 'efficiency', the ratio of hours earned to hours expended. This figure was used to compare production units from shop to division level. In fact, each facility's efficiency was compared to others in a report to Congress (35: 4-Analysis).

Problem areas which were identified at Cherry Point included budget overruns due to inflation of costs, unreported backrobbing of items to cover material stockouts and goal incongruency between the facility as a whole and individual work centers (35:13-14). Such efforts have

provided valuable general information but there remains a great lack of quantitative data of productivity factors. Explicit research is still required at the depot maintenance activity.

A contract engineering study of factors affecting productivity was conducted at NARF Cherry Point in 1978 (6). The study was comprehensive in its examination of the functional areas of the NARFs operation, although the questioning of managers and supervisors was not rigorously conducted. The study centered on management aspects of the NARF such as workload control and goal setting. The findings included as prime factors, the lack of automatic data processing support, incongruency of shop and facility production goals and inappropriate work standards. Secondary factors included lack of supervisory training, use of overtime, and unplanned workload fluctuation (6:12-13).

In March, 1981 results of an extensive inquiry into employee opinions about productivity at the NARF were reported, along with recommendations of the NARF Cherry Point Productivity Advisory Committee. The method of data collection was solicitation of voluntary inputs from all divisions and the committee's recommendations were based on observation and discussion of the 325 comments received, most of which were from the production branches. Areas where improvement was recommended included parts availability, improved administrative procedures, improved goal setting and

dissemination of goals, training, more realistic standards, availability of tools and improved worker morale (28: Recommendations Section).

Recent studies of organizational effectiveness in the DOD environment emphasize the role of the individual in improving the organization. Keith asserts that there is vast untapped potential for workplace and performance improvement in the DOD and suggests procedures for exploiting this resource (17). Tolchinsky studied the effects of survey feedback information on several aspects of organizational environment and perceived effectiveness, using ANOVA and regression techniques to analyze survey responses from forty-nine work groups at a major Air Force maintenance facility (40).

French and Steele conducted a study of the impact of skill on the productivity of Air Force maintenance personnel using man-hour data from the maintenance data collection system (MDC). 'Manhours used' was the measure of productivity. Regression analysis was used to analyze results from 110 cases. It was concluded that skill could be used to predict productivity although the results of the thesis were not directly applicable to the field because of the lack of data validity (9:74).

Cameron and Moore studied the effects of job enrichment on 122 career-oriented Air Force middle managers in a laboratory setting. Using ANOVA techniques, they showed

that there were significant positive effects of job enrichment on task performance in groups and, moreso, in individuals (1:87).

Several questionnaire items for this study were drawn from the Organizational Assessment Package (OAP) (11). The OAP is based on the Three Component Effectiveness Model initially reported by Hendrix (12). According to this model, effectiveness is a function of situational environment, managerial style and the criterion selected. The OAP was designed to measure these components.

The nine factors initially hypothesized were developed from conversations with managers at NARFs Cherry Point, Jacksonville and Pensacola and recent studies conducted at NARFs (7,8,28,35). NARF managers were asked to respond to these tentative factors prior to the formulation of the questionnaire based on them. A sample tentative factors survey and summary of managers' responses is provided in Appendix B.

Definition

Perceived Productivity - the operational definition of productivity used for this thesis was the factor score of each individual for the factor determined to be 'perceived productivity'. The determination was based on the factor analysis procedure used to reduce the questionnaire response data.

Objective

The objective of this thesis is to provide a well-substantiated set of factors which are affecting productivity in the Naval Air Rework Facilities (NARFs) and to show relationships between these factors and perceived productivity. This will provide a basis for further research and a tool for current management policy-making.

Research Questions

1. What are the factors affecting productivity at the NARFs?

2. What is the internal consistency of the responses to items comprising factors defined by the analysis?

3. Can factor scores for the factors defined be used to predict perceived productivity?

Research Hypotheses

Hypothesis I: Number of factors identified

H_o: Factors = 9 (as shown in Appendix B)

H_1: Factors $\neq$ 9

Hypothesis II: Internal Consistency of items comprising factors

H_o: Alpha $\leq$ .65

H_1: Alpha > .65

Hypothesis III: Significance of Beta coefficients in the regression function

H_o: $B_i = 0$

H_1: $B_i \neq 0$

CHAPTER III

METHODOLOGY

Environment

The environment which this study addressed was the Naval Air Rework Facility (NARF). A NARF is a depot-level aviation maintenance activity which supports the U.S. Navy and Marine Corps through the rebuilding and repair of aircraft, associated components, ground support equipment, avionics equipment and the providing of engineering services. Some of these services are provided under contract to other Services. There are six NARFs employing a total of about 24,000: NARF Alameda, near San Francisco and NARF North Island, near San Diego are the West Coast facilities. On the East are two NARFs in Florida, one in North Carolina and one in Virginia. These are NARFs Pensacola, Jacksonville, Cherry Point and Norfolk, respectively (35:1-2).

Every NARF has its own unique workload and capabilities but an overview of one facility's operations illustrates the kind of organization under study. NARF Cherry Point employs about 2,500 people and 80 Marines. It provides rework (overhaul) services on F-4, CH-46, OV-10 and AV-8 aircraft. Engines reworked at Cherry Point include the T-58, T-74, T-76, T-400 and F-402 models. In addition to these

the NARF has established capability to rework thousands of components, accessories, electronic items and aviation-related equipment.

The Production Department has four divisions, functionally divided into ninety work centers and employs about 1400 people. The production activity is not only large, it is complex. This and the great variety of items which are reworked make each NARF a unique productivity assessment problem. Rockwell identifies the primary mission of the facility to be production performance - to improve production efficiency and meet negotiated turnaround time (TAT). TAT is determined between the facilities and the Navy Aviation Logistics Center (NALC) and workload is budgeted according to the TATs negotiated. Efficiency is calculated as the ratio of 'earned' hours to actual 'expended' hours on each job. These figures are provided by computer programs for management use (35:5).

Although each NARF is unique, they all have a common organizational structure and mission. Only three facilities provided direct information for this study for reasons of time and costs of conducting the survey and analyzing the results. The three selected are similar in size (2500 to 3000 employees each) and in geographic area - Cherry Point, Jacksonville and Pensacola. Appendix A provides an abbreviated organizational chart of NARF Cherry Point. Because of the homogeniety between NARFs it is felt that the study's

results provided useful information about factors which affect productivity at all six facilities.

Population Description

The three NARFs chosen for this study employ approximately 8000 individuals, 4500 of whom are Wage Grade production line workers and supervisors. These production employees were the population for this study.

Data Collection

Factor Survey

Responses to the Tentative Factors Survey were obtained by requesting the Commanding Officer of each NARF under study to have appropriate managers respond to the instrument provided. Appendix B contains sample letter, survey and summarized responses.

Questionnaire

Subjects for the Production Employee Questionnaire were selected by stratified random sampling from current employee listings for each NARF. Thirty names were selected from each production branch at NARF, Cherry Point. Ten names were selected from each production branch at NARFs Jacksonville and Pensacola. Had all requested samples been returned, this would have yielded 420 from NARF Cherry Point, 160 from NARF Jacksonville and 150 from NARF Pensacola.

Out of the 730 requested, seventy-seven percent (560) were returned. Ninety-five percent of these (534) were useable responses, the remaining 26 being incorrectly completed.

Instruments

Factor Survey

The Tentative Factor Survey listed nine factors which are reported to affect productivity and requested managers to comment on the adequacy and appropriateness of the factors identified (Appendix B).

Questionnaire

The Production Employee Questionnaire consisted of seventy-two items to which employees were asked to respond on a Likert-type scale of one to seven. The additional response 'ten' was provided to indicate non-applicability of that question to the employee.

The items used were developed from the nine factors postulated by the researchers and from items used in the Organizational Assessment Package (11). About seven items from each of the nine postulated factors constituted the first sixty-nine items. The remaining three items were demographic (Appendix C).

Purposes of the Questionnaire

There were three purposes of the questionnaire: to assess employee opinions of work-related topics which are

believed to connect with perceived productivity, to provide a means of identifying clusters of correlated responses, and to provide a 'perceived productivity' factor to serve as the dependent variable factor. The factors identified by analysis of the questionnaire were used to test Research Hypothesis I.

Internal Consistency

A reliability-testing procedure was performed on the items determined by factor analysis to comprise each factor. The purpose of the procedure was to determine the internal consistency of the items so as to enable the researchers to evaluate each item's contribution to the factor in the presence of the other items. The reliability coefficient obtained was used to test Research Hypothesis II.

Experimental Design

The design of this study is necessary to provide information to determine if there are discrete factors which are predictive of the dependent variable factor - perceived productivity.

Factor Analysis and Regression programs were used to process the data into meaningful information and to test Hypotheses I and III.

Factor Analysis

Factor analysis is a collection of techniques which enable the researcher to detect underlying patterns in data

and to group this data into factors or patterns. Factor analysis was used to determine if the grouped questions or variables represented the factors hypothesized by the researchers.

The first step in the factor program was to review the correlation matrix. All the variables or responses from the questionnaire were assembled into a correlation matrix which gave the relationships between all these variables. If two or more responses were highly correlated, they reflected some common variability in the data.

The second step in the program was to extract the initial factors from the data. This program reduced the data into a set of factors based on the interrelatedness of the data elements. The Principle Factoring with Iterations (PA2) method was used to transform these variables into factors that were uncorrelated when using the orthogonal method. The orthogonal rotation (VARIMAX) extracted the factors so that they were independent from each other (29:470).

The eigenvalues, sum of the squared loadings, for each factor were given in the factor analysis program. They measured the amount of variance attributable to each factor. This enabled the user to decide how many factors to keep so that the variables would be adequately represented. An eigenvalue of one was used as a stop criterion for factor inclusion.

The next step was to examine the factor loadings. Factor loadings are the correlations between the variables and the factors (21:6-25).

The loadings shown on the rotated factor matrix were examined to determine which variables (items) loaded well with which factors. The criterion of 0.50 was used on factors with high loadings to choose which items made up the factor. A criterion of 0.30 was used on factors with low loadings. Care was taken to ensure that the same item did not load strongly under more than one factor.

Factor scores were produced for all cases to estimate the value of each factor identified in the model (21:6-3).

Regression

A linear multiple regression model was used to determine the relationship between the factor scores (X_{ij}) of the factors identified and the factor score of the dependent variable perceived productivity (Y_i).

The model used is mathematically stated:

$$Y_i = B_o + B_1 X_{i1} + B_2 X_{i2} + \ldots + B_j X_{ij} + E_i$$

where $i = 1,2,\ldots n$ for n subjects

$j = 1,2,\ldots k$ for k factors

E is a N(0,1) random error term

The statistical significance of each B_j (coefficient of the independent variable) was tested to determine if each B_j was significantly different from zero. (Research Hypothesis III).

If the coefficient were significantly different from zero, then the factor associated with that coefficient was useful in predicting the dependent variable (21:4-44).

The value of the model in predicting perceived productivity is necessarily dependent on which other variables are included in the model. So, multiple iterations were performed by the computer to come up with the best predictive model. The stepwise method was used to perform these iterations. Factors were added one at a time and then considered for deletion from the model by the use of a partial F-test (21:4-60).

Assumptions and Limitations

Several assumptions were necessary to conduct this study. First, the interval nature of the Likert scale was assumed, based on recent literature and similar use in other studies of this type. The aptness of the linear regression model was also assumed. This depends on the linearity of the regression function which is indicated by the random scatter of residual (error) values about a fitted straight line. Candid responses from subjects were assumed. It was emphasized in each letter transmitting questionnaires to each NARF and on the questionnaire completion instructions, that this was important and that there was no gain in distortion of responses. Additionally, careful instructions were given to assure the correct administration of the questionnaire in the NARFs.

The sample size and number of questions were limited by the manpower costs entailed. The sample sizes chosen were the best obtainable by the researchers.

Pretesting of the instrument and modifying it may have increased the instrument reliability and may have led to a more predictive regression model.

CHAPTER IV

ANALYSIS AND RESULTS

Overview

The questionnaire response data was analyzed using three techniques. First, factor analysis was used to reduce the data and identify relevant underlying dimensions. The results of this process were used to test Research Hypothesis I. Second, internal consistency of the factors identified was determined using the Cronbach's Alpha technique. The results were used to test Research Hypothesis II. Third, the factors found to be sufficiently consistent were used to build a linear multiple regression model to predict variability in the factor "perceived productivity". The partial F statistics produced for the coefficients in the model were used to test Research Hypothesis III.

Factor Analysis

Responses to questionnaire items one through fifty-eight and sixty-three through sixty-nine were factor analyzed. Items fifty-nine through sixty-two were analyzed separately to produce the 'perceived productivity' factor. Items seventy through seventy-two were demographic and were not used in this study. Where an item response was marked

'ten', meaning 'not applicable', pairwise deletion was used to eliminate that response from the factor analysis.

Number of Factors

The eigenvalues and percentages of variance shown in Table 1 were provided by the initial factor analysis program. This table indicates the percent of variance by factor of the original data, prior to data-reduction.

The criterion for determining whether to retain a factor in the analysis initially was an eigenvalue of one or greater. The application of this criterion resulted in the initial selection of nineteen factors. The number of factors was further reduced to eleven by the use of the following criteria: minimum factor loadings of .50 for heavy-loading factors, .30 for light-loading factors, and items which appeared to load logically together.

Item-Factor Validity

Two criteria were used to determine which items should be included to identify each factor: the first criterion was that the item load according to the criteria in the above paragraph, and that the item not load highly under more than one factor, i.e., be factorially simple. The second criterion was that there be a clear connection between the items constituting a factor. The results of applying these criteria to the factors obtained are shown in Table 2.

TABLE 1

Initial Eigenvalues of >1 and Percent of Variance Values for Unreduced Data (Items 1 through 58 and 63 through 69)

Factor	Eigenvalue	Percentage of Variance	Cumulative Percentage
1	11.81598	18.2	18.2
2	4.04605	6.2	24.4
3	2.41253	3.7	28.1
4	2.02039	3.1	31.2
5	1.91494	2.9	34.2
6	1.87889	2.9	37.1
7	1.64079	2.5	39.5
8	1.61053	2.5	42.1
9	1.53727	2.4	44.4
10	1.40428	2.2	46.6
11	1.34466	2.1	48.7
12	1.30836	2.0	50.7
13	1.25512	1.9	52.5
14	1.19520	1.8	54.4
15	1.15194	1.8	56.2
16	1.08919	1.7	57.9
17	1.05014	1.6	59.5
18	1.04332	1.6	61.1
19	1.00111	1.5	62.7

TABLE 2

Items Comprising each Factor

Factor Loadings		Questions
		Factor 1: Supervision
.554	9	To what extent does your supervisor provide the assistance you need to get the job done?
.623	47	My supervisor has a thorough knowledge of all work done in my shop.
.635	48	My supervisor lets me know exactly what is expected of me in doing my job.
.537	64	My supervisor sets high performance standards.
.706	65	My supervisor encourages teamwork.
.645	66	My supervisor frequently gives me feedback on how well I am doing my job.
		Factor 2: Workload Control
.610	36	Production is scheduled realistically in my work shop.
.571	38	When production needs change, work is rescheduled smoothly.
.640	42	Production norms are fair and consistent.
.520	43	When a production norm or standard is wrong it gets changed.
.502	45	Production norms and standards are promptly established for new work.
.612	54	Workload is planned so that if flows evenly in the shop.
		Factor 3: Equipment
.797	28	Equipment, such as jigs, machinery and test gear, is up-to-date.
.750	29	Equipment, such as jigs, machinery and test gear, is readily available when needed.
.805	30	Equipment, such as jigs, machinery and test gear, is in a good state of repair at all times.

TABLE 2 (Continued)

Factor Loadings		Questions
		Factor 4: Repair Kits
.624	23	Repair parts are readily available at or near the work place when they are needed.
.761	24	Change and repair kits are readily available when needed.
.700	25	Change and repair kits are complete and contain useable parts.
		Factor 5: Training Quality
.530	2	To what extent has training you have received actually helped you do your work?
.698	3	To what extent is job training readily available to you?
.513	33	High quality technical training is provided when needed.
		Factor 6: Technical Data
.793	39	Technical publications are readily available for my work.
.803	40	Technical data for my job, such as drawings and specifications, are readily available for my use.
		Factor 7: Job Knowledge
.508	13	To what extent do you know exactly what is expected of you in performing your job?
.520	20	To what extent does your job provide the chance to know for yourself when you do a good job and to be responsible for your own work?
		Factor 8: Overtime
.708	10	To what extent does working overtime benefit production?
.617	11	To what extent do supervisors use overtime effectively?

TABLE 2 (Continued)

Factor Loadings		Questions
		Factor 9:Goal Attainment
.333	12	To what extent are you loaned to other shops because of work fluctuations?
.342	46	Excessive administrative duties keep supervisors from doing their jobs.
.359	63	Often the paper-work connected with my job prevents me from performing the work.
		Factor 10: Job Satisfaction
.376	21	To what extent do you have the chance to help people and improve their welfare through the performance of your job?
.351	22	To what extent does your job require you to do many different things, using a variety of your talents and skills?
		Factor 11: Need for Training
.448	4	To what extent could you benefit in doing your job by more technical training?
.357	35	My productivity would benefit from more work-related training.
		PERCEIVED PRODUCTIVITY
.684	59	The quality of output of my shop is very high.
.638	60	The quantity of output of my shop is very high.
.500	61	My shop always gets maximum output from available resources.
.670	62	My coworkers maintain high standards of performance.

Factor Descriptions

Factor 1 - Supervision

Percent Variance Accounted for: 18.2

Coefficient Alpha (Internal Consistency): .827

This factor refers to the quality of supervision in the workplace as determined by assistance provided to subordinates, knowledge of the work, communication of expectations, establishment of performance standards, encouragement of teamwork and feedback.

Factor 2 - Workload Control

Percent Variance Accounted for: 6.2

Coefficient Alpha (Internal Consistency): .845

This factor refers to workload scheduling and performance standards. It involves smooth and realistic scheduling of work, and fairness, consistency and timeliness of work standards.

Factor 3 - Equipment

Percent Variance Accounted for: 3.7

Coefficient Alpha (Internal Consistency): .898

This factor refers to various types of equipment such as machinery and test gear. It involves availability, condition and quality of equipment.

Factor 4 - Repair Kits

Percent Variance Accounted for: 3.1

Coefficient Alpha (Internal Consistency): .802

This factor refers to quality and availability of change and repair kits. A change kit provides parts needed

to alter the configuration of an item. A repair kit provides parts needed to perform a given level of repair.

Factor 5 - Training Quality

Percent Variance Accounted for: 2.9

Coefficient Alpha (Internal Consistency): .696

This factor refers to the quality and availability of work-related training. This includes job training and technical training.

Factor 6 - Technical Data

Percent Variance Accounted for: 2.9

Coefficient Alpha (Internal Consistency): .828

This factor refers to the availability of job-related technical data. This data refers to drawings, specifications and publications used to support the production process.

Factor 7 - Job Knowledge

Percent Variance Accounted for: 2.5

Coefficient Alpha (Internal Consistency): .716

This factor refers to the individual's knowledge of what is expected in performing their job and how well they do their job.

Factor 8 - Overtime

Percent Variance Accounted for: 2.5

Coefficient Alpha (Internal Consistency): .730

This factor refers to increasing production through the use of overtime and the supervisors abilities to use overtime effectively.

Factor 9 - Goal Attainment

Percent Variance Accounted for: 2.4

Coefficient Alpha (Internal Consistency): .340

This factor refers to aspects of the work environment that obstruct goal attainment. These include work fluctuations, unrealistic performance goals, excessive administrative duties and paperwork.

Factor 10 - Job Satisfaction

Percent Variance Accounted for: 2.2

Coefficient Alpha (Internal Consistency): .440

This factor refers to the satisfaction that the job provides to the individual. This involves satisfaction with the knowledge of the benefits provided to others through job performance and satisfaction with the extent to which the job provides the opportunity for an individual to use his talents and skills.

Factor 11 - Need for Training

Percent Variance Accounted for: 2.1

Coefficient Alpha (Internal Consistency): .432

This factor refers to the need for job-related training. The benefit is in terms of the needs of the organization and the individual.

Perceived Productivity

Percent Variance Accounted for: 54.6

Coefficient Alpha (Internal Consistency): .707

This refers to the quality, quantity and efficiency of shop performance. It involves the worker's perception of

standards that co-workers maintain and the level of output the shop maintains through the use of resources.

Internal Consistency

The internal consistency of each factor was determined by use of the Cronbach's Coefficient Alpha test referred to in Chapter III. The results are presented in Table 3 and individually under Factor Descriptions. The Alpha values produced were used to test Research Hypothesis II:

H_o: Alpha $\leq$ .65

H_1: Alpha > .65

By application of this test factors one through eight were accepted as reliable and factors nine through eleven were rejected as unreliable. Only the factors which were accepted as reliable were used in the regression analysis.

Regression Analysis

Regression analysis was used to develop a model to predict perceived productivity from a linear combination of the eight factors which survived the internal consistency test. Each individual had their factor score computed for each of the following factors:

Dependent Variable

Perceived Productivity (Y)

Independent Variables

Supervision	Factor 1	(X_1)
Workload Control	Factor 2	(X_2)
Equipment	Factor 3	(X_3)
Repair Kits	Factor 4	(X_4)
Training Quality	Factor 5	(X_5)
Technical Data	Factor 6	(X_6)
Job Knowledge	Factor 7	(X_7)
Overtime	Factor 8	(X_8)

TABLE 3

Cronbach's Coefficient Alpha Test for Eleven Factors and Perceived Productivity

Factor	Alpha
Supervision	.827
Workload Control	.845
Equipment	.898
Repair Kits	.802
Training Quality	.696
Technical Data	.828
Job Knowledge	.716
Overtime	.730
Goal Attainment	.340
Job Satisfaction	.440
Need for Training	.432
Dependent Variable	
Perceived Productivity	.707

Independent Variables in Solution

To determine the best possible linear combination of factors, several regression models were constructed by stepwise regression. The model chosen was that combination which provided the highest coefficient of determination with an overall F significance level of .05 or less and all coefficients significantly different from zero (Research Hypothesis III):

$$H_o: B_i = 0$$

$$H_1: B_i \neq 0$$

Decision rule: F-test significance level $\leq .05$, reject H_o

F-test significance level $> .05$, accept H_o

As a result of the application of this test, three of the independent variables - Factors 4, 6, and 7 - were eliminated from the model. The regression model selected was the following combination of variables 1, 2, 3, 5 and 8:

$$Y = -.9468 + 0.2494\ X_2 + 0.2409\ X_1 + 0.1542\ X_8 + 0.1147\ X_5 + 0.0972\ X_3$$

According to this model the order of importance of the significant factors in predicting perceived productivity was:

Workload Control (X_2)

Supervision (X_1)

Overtime (X_8)

Training Quality (X_5)

Equipment (X_3)

The coefficient of determination (adjusted for the relationship between sample size and number of variables) was $R^2 = 0.1939$, $F(26.63)$, $P < .001$. This indicates that slightly over 19% of the variance in perceived productivity was explained by the model.

CHAPTER V

CONCLUSION

This study resulted in the identification of eleven distinct factors which are useful concepts for further research and management action. Factors previously identified by less formal studies and by management were validated at the employee level.

Comparison to the Hypothesized Factors (Refer to Table 4)

The data indicated that although the eleven factors did not perfectly match those hypothesized, most were very similar in content. The Workload Control factor found corresponded to portions of three of the hypothesized factors. A distinction between Quality of Training and the Need For Training appeared, which was not anticipated by the researchers. Technical data emerged as a single factor rather than being a portion of the Adequacy of the Work Environment, as the researchers expected. Similarly, Overtime and Job Satisfaction emerged as single factors rather than grouping under the hypothesized Employee Satisfaction. Factor Items were not generated specifically for the ninth hypothesized factor as this was highly management-oriented.

TABLE 4

Factors Identified Compared to Factors Hypothesized

Factors Identified		Factors Hypothesized
Supervision	-	Supervisor control, training, support, communication.
Workload Control	-	Production scheduling and production support. Production standards, norms, policies. Workload induction, planning, fluctuations in workload and effects of erratic workload.
Equipment	-	Adequacy of work environment, tools and equipment.
Repair Kits	-	Parts control, availability and material support, including the development and issue of kits.
Quality of Training	-	Training of employees.
Technical Data	-	Adequacy of work environment. . .
Job Knowledge	-	Employee satisfaction, utilization, attitudes, use of leave, overtime, promotion standards.
Overtime	-	Employee satisfaction. . .
Goal Attainment	-	Adequacy of work environment, tools and equipment.
Job Satisfaction	-	Employee satisfaction. . .
Need for Training	-	Training of employees.

Instrument

The researchers have developed an instrument which can be used to assess employee's opinions about various aspects of the work environment. Further refinement of the questionnaire could increase its usefulness and the predictive ability of the factors emerging from its application and analysis.

Method

The researchers have developed a methodology for validating hypothesized productivity factors in the industrial environment. The same method can be used with other data bases to identify other factors in the NARFs and other organizations. Other measures of productivity such as 'hard' measures, like production reports, can be used as dependent variables in the regression analysis. Such measures were not used in this study because of evidence in the literature and manager's comments which indicated that the available 'hard' measures were reliability insufficient.

Model

Five of the eleven factors were shown to predict perceived productivity to a statistically significant degree. They were: Workload Control, Supervision, Overtime, Quality of Training, and Equipment. Additional research could uncover new factors which, in concert with these, might predict more of the variance in perceived productivity.

Summary

Industrial productivity continues to be a deep concern for labor and management in both the public and private sectors of the economy. The researchers have concentrated on one type of industrial concern - the Naval Air Rework Facility. A model has been constructed which predicts perceived productivity from five of the factors identified by the researchers.

In all, eleven factors were identified and presented. Although six of these could not be used to predict productivity to a significant extent, their emergence as underlying dimensions of employees' responses to the questionnaire supports the need for additional attention being given to them. The five predictive factors provide a basis for management action in the continuing effort to improve the productivity of the Facilities.

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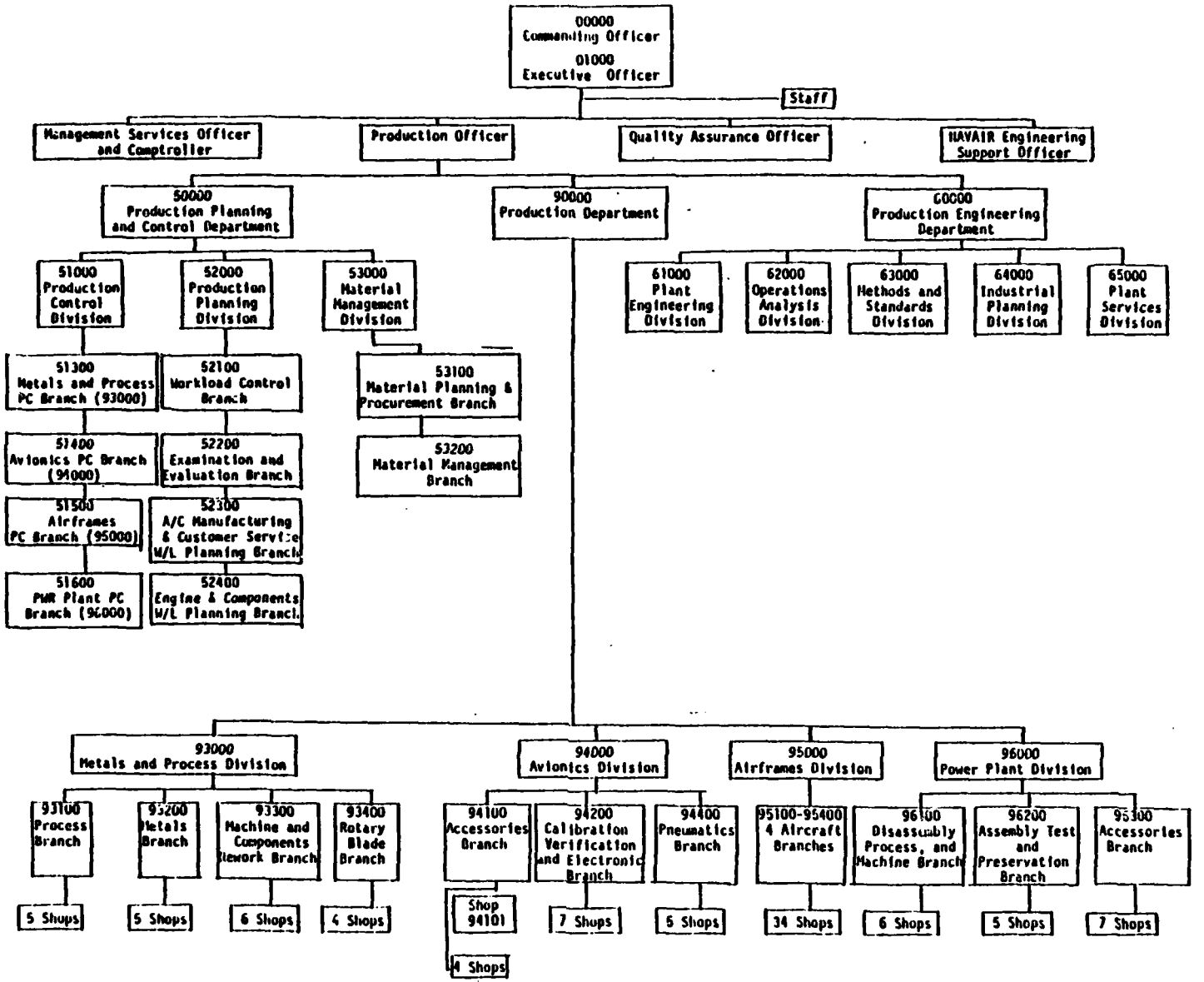
APPENDIX A

ORGANIZATIONAL CHART

Exhibit 1

NARF Cherry Point Organization Chart



APPENDIX B

FACTORS OF PRODUCTIVITY

The purpose of the Tentative Factors Affecting Productivity survey was to give managers a chance to comment on the adequacy and completeness of the factors initially identified for this study.

Six copies were sent to each NARF in the study - Cherry Point, Jacksonville and Pensacola. One completed form was received from Cherry Point. Additionally, two forms were returned with comments to the effect that all the factors were appropriate. Jacksonville returned one completed survey. Pensacola returned eleven surveys.

Most of the responses went beyond commenting on the tentative factors in general and provided specific problems in work areas pertinent to each factor. Following the sample letter used to transmit the survey, with enclosure, are summaries of the responses received.

November 19, 1980

FROM: Mr. Stephen N. Bernard
Lt. Janice W. Allton
Class 81J, Logistics Mgt. Dept.
School of Systems and Logistics
Air Force Institute of Technology
Wright-Patterson AFB, OH. 45433

TO: Commanding Officer
Naval Air Rework Facility
NAS, Pensacola, Fla. 32508

SUBJECT: Tentative Productivity Factors

REFERENCE: (a) Letter from Mr. Bernard and Lt. Allton to NAVAIREWORKFAC Cherry Point, dated 19 November 1980, Enclosure (1) List of tentative productivity factors.

1. As discussed in Reference (a) a set of factors has been identified as affecting productivity at NAVAIREWORKFAC's. These tentative factors are listed in Enclosure (1) and are provided to production managers and other management personnel for comment on their appropriateness and adequacy. Space is provided after each for a short comment by the participant. Additional space is provided at the end for other important factors affecting productivity that have not been included or comments on those factors presented.

2. Comments are invited from as many managers and supervisory personnel as the Commanding Officer deems appropriate, considering the type of information needed and the time required to respond.

3. It is requested that the completed sheets be returned to the undersigned within two weeks as the information will be used to write the questionnaire for a study of the factors affecting productivity at the NAVAIREWORKFAC's. This questionnaire must be completed by January, 1981.

Stephen N. Bernard
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TENTATIVE FACTORS AFFECTING PRODUCTIVITY

Please comment on the appropriateness and adequacy of each factor. Additional space is provided at the end of this Enclosure.

1. Parts Control, availability and Material Support, including the development and issue of kits.

2. Workload induction, planning, fluctuations in workload and effects of erratic workload.

3. Adequacy of work environment, tools and equipment.

4. Training of employees.

5. Production scheduling and production support.

6. Production standards, norms, policies.

7. Supervisor control, training, support, communication.

8. Employee satisfaction, utilization, attitudes, use of leave, overtime, promotion standards.

9. Effectiveness of management and production information, ADP support, measures of productivity, communication between workers and management.

Additional Responses.

Enclosure (1)

Thank you

SUMMARIZED COMMENTS

1. Parts control, availability and material support, including the development and issue of kits.

This factor was emphasized as very important to productivity. Specific comments are summarized:

- Parts control suffers from inefficient procedures and lack of experience of production controllers.
- Non-availability of spare parts and expendable materials results in lost man-hours.
- Material planning needs improvement.

2. Workload induction, planning, fluctuations in workload and effects of erratic workload.

This factor was cited as very important, particularly in the 'erratic workload' aspect. Specific comments are summarized:

- Erratic induction of Standard Depot Level Maintenance (SDLM) and Felled Equipment (F/E) components makes planning difficult.
- There is a lack of correlation between workload and resources allocated.
- Work content of SDLM items is unpredictable.
- Assets (items to be worked) are sometimes not available because of Aviation Supply Office policies and procedures.

- Excessive 'hand write' shop orders circumvent the normal workload control process.

3. Adequacy of work environment, tools and equipment.

While this factor was seen as important to productivity, comments indicated that there are few serious problems in this area. Specific comments are summarized:

- Most important aspect of this factor is obsolescence of equipment and technology lag.
- Generally, the work environment is good but floorspace is lacking.
- Maintenance and calibration of tools and tool availability are problems in some areas.

4. Training of employees.

Training was not emphasized as a major problem although it was recognized as important to productivity. Specific comments are summarized:

- Work is needed in identifying where training is most needed.
- Some less important training is conducted while funds for critical training are lacking.
- Training is needed in transactor discipline, skilled trades and supervision.

5. Production scheduling and production support.

This factor was considered moderately important to productivity. Specific comments are summarized:

- Lack of timely definition of work required to complete an item is a problem.

- Untimely material and technical data support slows processing.
- This factor is connected with the parts availability and material support aspects of the first tentative factor.

6. Production norms, standards and policies.

This was not emphasized as a major productivity problem, although several problems in the area of norms and standards were identified. Specific comments are summarized:

- Norms (time standards for large assemblies, like aircraft) are late in changing to reflect requirements changes.
- Standards are not consistently accurate, especially for smaller items.
- More 'A' (engineered) standards are needed.
- Rockwell work standards are not consistently accurate.

7. Supervisory control, training, support, communication.

This was emphasized as an important factor. Specific comments are summarized:

- Excessive paperwork hampers supervision.
- Supervisors have inadequate freedom of action because of union and management policies.
- More supervisory training, i.e., especially for new supervisors.

- Communication between levels of management needs attention.

8. Employee satisfaction, utilization, attitudes, use of leave overtime, promotion standards.

This was evaluated as an important factor but too broad in scope as written. Specific comments are summarized:

- Policies should be more standardized from one work unit to another.
- Supervisors need to be able to control the use of leave more effectively (particularly sick leave).
- Promotion policy, while generally fair, needs standardization of promotion criteria.
- Morale problems with temporary employees stem from unsureness about their positions.

9. Effectiveness of management and production information, ADP support, measures of productivity, communication between workers and management.

This factor was described as very important to productivity, although too broad as written. The quality of ADP support received particular attention. Specific comments are summarized:

- Computer support is untimely and inaccurate (several such comments).
- Information fed back is conflicting.
- To much information is provided, not enough of which is useful.

Additional Responses.

- The correlation between workload assignment and ceiling (manpower authorizations) is poor.
- There are trade-skill imbalances in the workforce.
- The pay disparity between NARF workers and private sector counterparts is a problem in some occupations.

APPENDIX C

QUESTIONNAIRE

NAVAL AIR REWORK FACILITY
PRODUCTION EMPLOYEE QUESTIONNAIRE

You have been selected to participate in a study investigating aspects of effectiveness of the Naval Air Rework Facilities (NARFs). The questionnaire which follows will ask you about your organization, your supervisor and your job. Each NARF in the study will be provided with the results to continue the improvement of the NARFs as places of work.

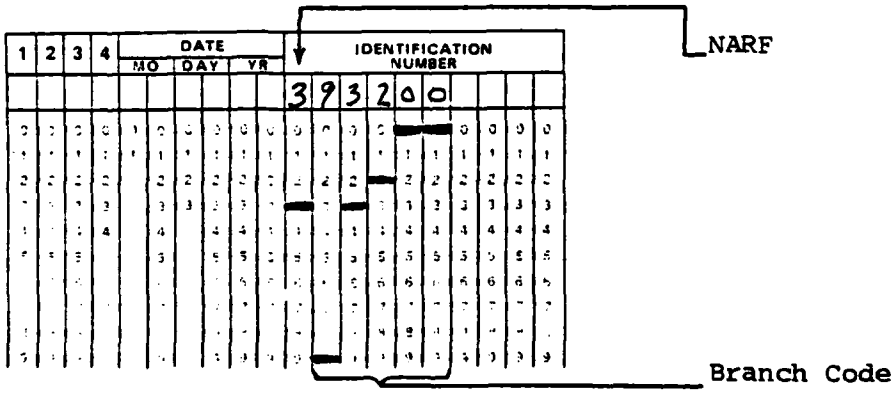
PRIVACY ACT STATEMENT

1. Authority: 10 USC 8012, Secretary of the Air Force, Powers, Duties, Delegation of Compensation E.O. 0307, 22 Nov 43, Numbering System for Federal Accounts relating to Individual Persons.
2. Principle Purposes: This information will be used for research to identify aspects of organizational effectiveness.
3. Routine Uses: Informations provided will be treated confidentially and will be used for academic research purposes.
4. Participation: Your response is voluntary. Your cooperation is appreciated.

BRANCH IDENTIFICATION

Your name is <u>not</u> required. The only identification needed is that of your organization. Go to the section in the corner of your answer sheet titled "IDENTIFICATION NUMBER". Fill in the first six blocks according to the following instructions:

1. In the first column enter the number corresponding with your NARF as follows: 1 = Cherry Point, 2 = Pensacola, 3 = Jacksonville.
2. Enter your five digit Branch Code in columns 2-6.
3. Blacken the proper spaces, beneath the numbers, using a number 2 pencil. For example, if you work in the 93200 Branch of NARF Jacksonville your response would look like this:



It is important that you answer all items honestly. Your individual responses are confidential and will not be provided to your organization or any other. Only group summary data will be provided.

<u>DO NOT STAPLE OR OTHERWISE DAMAGE THE ANSWER SHEET</u>

QUESTIONNAIRE

Instructions

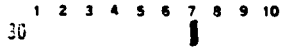
Responses to the questions are to be made on a seven point (1-7) scale; the number 10 response will be used to indicate that the question is not applicable to you. Mark your answers on the separate answer sheet provided. Please use a number 2 pencil only. Make heavy black marks that fill the space under the number chosen. For example, using the scale below, if training is available for your job to a very great extent then you would blacken space number 7 as shown below:

Scale:
1 = Not at all
2 = To a very little extent
3 = To a little extent
4 = To a moderate extent
5 = To a fairly large extent
6 = To a great extent
7 = To a very great extent
10 = Not applicable

Sample Question:

80. To what extent is training for your job made available to you?

Answer response:



PART I

Below are questions related to your job. Read each question carefully and then decide to what extent it is true of your job. Mark your answer as described above.

1. To what extent is your work hindered by poor equipment?

2. To what extent has training you have received actually helped you do your work?

3. To what extent is job training readily available to you?

4. To what extent could you benefit in doing your job by more technical training?

5. To what extent are your production efforts aided by good organizational planning?

6. To what extent are items to be repaired in place when and where they should be?

7. To what extent do work standards reflect the actual time needed to do a job?

8. To what extent are you involved in establishing realistic work standards?

9. To what extent does your supervisor provide the assistance you need to get the job done?

10. To what extent does working overtime benefit production?

11. To what extent do supervisors use overtime effectively?

1 = Not at all
2 = To a very little extent
3 = To a little extent
4 = To a moderate extent
5 = To a fairly large extent
6 = To a great extent
7 = To a very great extent
10 = Not applicable

12. To what extent are you loaned to other shops because of work fluctuations?

13. To what extent do you know exactly what is expected of you in performing your job?

14. To what extent are the performance goals set by supervision difficult to accomplish?

15. To what extent are the performance goals set by supervision clear and specific?

16. To what extent are the performance goals set by your supervisor realistic?

17. To what extent does your job provide a great deal of freedom and independence in selecting your own procedures to accomplish your work?

18. To what extent does your job provide you the change to finish completely the piece of work you have begun?

19. To what extent do you have a chance to acquire valuable skills in your job which prepare you for future opportunities?

20. To what extent does your job provide the chance to know for yourself when you do a good job and to be responsible for your own work?

21. To what extent do you have the chance to help people and improve their welfare through the performance of your job?

22. To what extent does your job require you to do many different things, using a variety of your talents and skills?

PART II

Below are statements related to your job. Read each statement carefully and then indicate your level of agreement with the statement as it applies to your job. Then mark your answer sheet as previously described, using the following scale:

Scale:
1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree
10 = Not applicable

23. Repair parts are readily available at or near the work place when they are needed.

24. Change and repair kits are readily available when needed.

25. Change and repair kits are complete and contain useable parts.

26. Materials such as wire, adhesives and rivets are readily available at or near the work place when they are needed.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree
10 = Not applicable

27. Materials such as wire, adhesives and rivets, are of high quality.

28. Equipment, such as jigs, machinery and test gear, is up-to-date.

29. Equipment, such as jigs, machinery and test gear, is readily available when needed.

30. Equipment, such as jigs, machinery and test gear, is in a good state of repair at all times.

31. Tools, such as wrenches and drills, are readily available when needed.

32. Tools, such as wrenches and drills, are of high quality.

33. High quality technical training is provided when needed.

34. Time is wasted going to training which isn't really needed.

35. My productivity would benefit from more work-related training.

36. Production is scheduled realistically in my work shop.

37. My shop knows what work to expect in the near future.

38. When production needs change, work is rescheduled smoothly.

39. Technical publications are readily available for my work.

40. Technical data for my job, such as drawings and specifications, are readily available for my use.

41. Technical information provided for my work is complete and accurate.

42. Production norms are fair and consistent.

43. When a production norm or standard is wrong it gets changed.

44. Hours available for a certain job are used for that job only.

45. Production norms and standards are promptly established for new work.

46. Excessive administrative duties keep supervisors from doing their jobs.

47. My supervisor has a thorough knowledge of all the work done in my shop.

48. My supervisor lets me know exactly what is expected of me in doing my job.

49. Use of annual leave is fairly and consistently controlled in my shop.

50. I care a lot about the level of productivity of my shop.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree
10 = Not applicable

51. Work is loaded to my shop too fast for the shop's capabilities.

52. Work is loaded to my shop too slowly to use the shop's capabilities.

53. The amount of work loaded to my shop varies a lot from time to time.

54. Workload is planned so that it flows evenly to the shop.

55. My suggestions are taken seriously up the line of supervision.

56. More information about how well we are performing is needed by my shop.

57. The amount of time clocked on a job accurately reflects the actual time used to do the job.

58. When my suggestions are accepted, action is taken to put them into effect.

59. The quality of output of my shop is very high.

60. The quantity of output of my shop is very high.

61. My shop always gets maximum output from available resources.

62. My coworkers maintain high standards of performance.

63. Often the paper-work connected with my job prevents me from performing the work.

64. My supervisor sets high performance standards.

65. My supervisor encourages teamwork.

66. My supervisor frequently gives me feedback on how well I am doing my job.

67. My organization has a very strong interest in the welfare of its people.

68. This organization rewards individuals based on performance.

69. I feel responsible to my organization in accomplishing its mission.

BACKGROUND INFORMATION

Instructions

Please complete the following statements by blackening the corresponding number on the answer sheet:

70. Your total number of years with this organization (NARF) is:
    1. One or less
    2. One to five
    3. Five to nine
    4. Nine to thirteen
    5. Thirteen to seventeen
    6. Seventeen to twenty-one
    7. Twenty-one to twenty-five
    8. Twenty-five to twenty-nine
    9. Twenty-nine to thirty-three
    10. Thirty-three or greater

71. Your sex is:

    1. Male
    2. Female

72. Your age is:

    1. Twenty or less
    2. Twenty to twenty-five
    3. Twenty-five to thirty
    4. Thirty to thirty-five
    5. Thirty-five to forty
    6. Forty to forty-five
    7. Forty-five to fifty
    8. Fifty to fifty-five
    9. Fifty-five to sixty
    10. Sixty or more

THANK YOU FOR YOUR ASSISTANCE

END

DATE
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